Introduction to Passive Optical Network

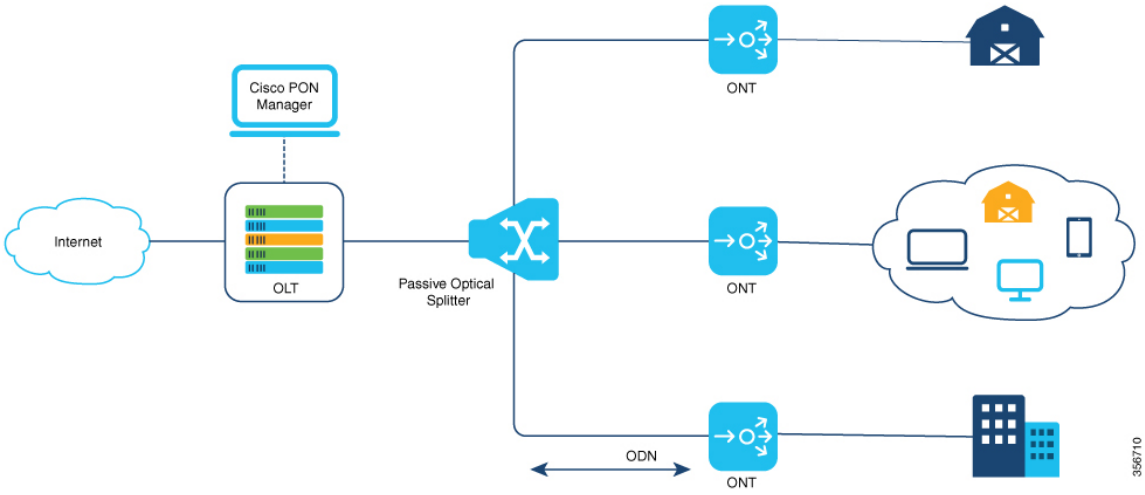
A passive optical network (PON) or Gigabit Passive Optical Network (GPON) is a point-to-multipoint (P2MP) network that uses a combination of active transmission equipments and passive cable components to provide network connectivity to end user's devices. This network is suitable for building access networks such as fiber-to-the-home (FTTH), or fiber-to-the-office (FTTO), or fiber-to-the-company (FTTC) for providing internet access by running fiber optic cable directly from an internet service provider to a user's home or business. The PON technology is based on the ITU-T G.984 standard.

PON transmits Ethernet, Asynchronous Transfer Mode (ATM), and Time Division Multiplexing (TDM) traffic. It consists of mainly two active transmission equipments, Optical Line Terminal (OLT) and Optical Network Terminal (ONT). One of the main characteristics of PON is the use of passive optical splitters in the fiber distribution network, enabling a single feeding fiber from the service provider’s central office to serve multiple homes and small businesses.

The network path between the terminals is known as Optical Device Network (ODN), which comprises passive optical components, such as optical fibers and passive optical splitters. The ODN provides optical channels that interconnect the OLT to the ONTs. The optical fiber cables cover a distance of 20km to 30km.

A single optical fiber from the OLT connects to a passive optical splitter that is located near an end user's premises. The optical splitter divides optical power into *n* separate paths to end user. The number of optical paths can vary from 2 to 128. From the optical splitter, a single-mode fiber strand is connected to each end user's devices. Data is broadcast in the downstream direction and transmitted in the TDMA mode based on timeslots in the upstream direction.

Figure 1: Components of GPON



The data, voice, and video signals of an end-user devices are sent to ONTs. The signals are converted into GPON Encapsulation Method (GEM) frames and then transmitted over optical fibers to the OLT using the PON uplink ports on the ONTs. On the OLT the GEM frames are converted into Ethernet packets and are forwarded to the upper-layer IP network using the uplink port on the OLT.

For more information, see the following sections:

- Cisco Catalyst PON Series OLT Overview, on page 2
- Cisco Catalyst PON Series ONT Overview, on page 7
- Cisco Catalyst PON Manager Overview, on page 15

Cisco Catalyst PON Series OLT Overview

The Cisco Catalyst PON Series OLT is an aggregation device that is located at a service provider's central office of the PON network. The main functions of a Cisco Catalyst PON Series OLT are traffic scheduling, buffer control, and bandwidth allocation. The Cisco Catalyst PON Series OLT manages the network traffic that is in the form of video, data, and voice signals in a PON network, and sends them downstream to the Cisco Catalyst PON Series ONTs on the network. The Cisco Catalyst PON Series OLT also receives the signals from the Cisco Catalyst PON Series ONTs located at an end user's premises and sends them to their destination over the internet.

A Cisco Catalyst PON Series OLT can support up to 128 Cisco Catalyst PON Series ONTs per port. A Cisco Catalyst PON Series OLT provides 8/16xPON ports, 4xG combo ports and 2x10G small form-factor pluggable (SFP+) ports for uplink. A Cisco Catalyst PON Series OLT carries abundant services and flexible network mode over one optical network, and is especially suitable for networks such as enterprise LAN, video application, and high-speed internet.

Cisco Catalyst PON Series OLT Models

The following table lists the Cisco Catalyst PON Series OLT models and their description.

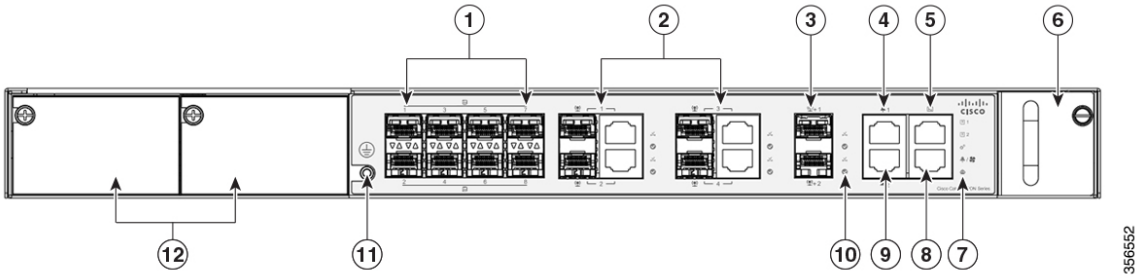
Table 1: Cisco Catalyst PON Series OLT Models and Description

Model	Description
CGP-OLT-8T	Cisco Catalyst PON Series OLT with 8xPON port, 4x1 G combo port, and 2x10 G SFP+ module uplink slot.
CGP-OLT-16T	Cisco Catalyst PON Series OLT with 16xPON port, 4x1 G combo port, and 2x10 G SFP+ module uplink slot.

Front Panel

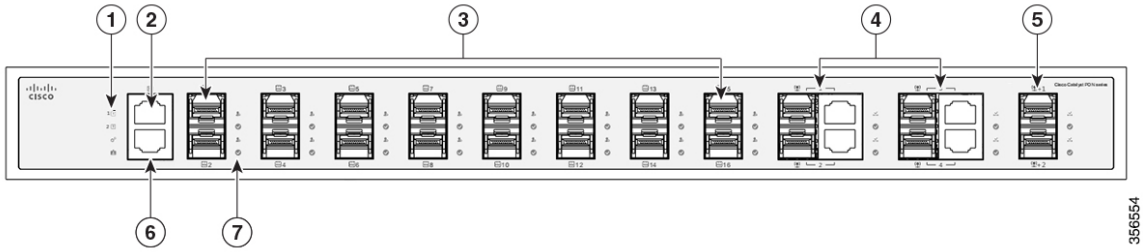
This section describes the front-panel components of Cisco Catalyst PON Series OLT.

Figure 2: Front Panel of CGP-OLT-8T



1	PON ports	7	System LEDs
2	1 G combo ports	8	Auxiliary port
3	10 G SFP+ ports	9	Reserve alarm port
4	Reserve alarm port	10	Port LEDs
5	Console port	11	Grounding connector
6	Fan module	12	Power modules

Figure 3: Front Panel of CGP-OLT-16T



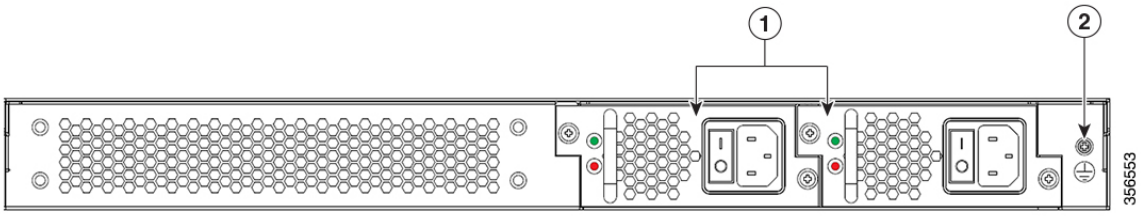
1	System LEDs	5	10 G SFP+ port
2	Console port	6	Auxiliary port

3	PON ports	7	Port LEDs
4	1 G combo ports	-	-

Rear Panel

This section describes the rear-panel components of CGP-OLT-16T:

Figure 4: Rear Panel of CGP-OLT-16T



1	AC or DC power connector	2	Grounding connector

Ports

PON Ports

The PON ports use multi-source agreement (MSA) type UPC or SC-PC fiber connector. The PON ports support a bandwidth of 2.466 Gbps downstream and 1.244 Gbps upstream.

Console Port

The console port connects the Cisco Catalyst PON Series OLT to a PC running Microsoft Windows or to a terminal server and uses the RJ-45 crossover cable. The RJ-45 console port connection uses the supplied RJ-45-to-DB-9 female cable.

Auxiliary Port

The auxiliary port connects the Cisco Catalyst PON Series OLT to a host such as a Windows workstation or a terminal server through the auxiliary port. The auxiliary out-of-band management port is a virtual routing and forwarding (VRF) interface and uses an RJ-45 crossover cable.

1 G Combo Ports

A combo port is a combination of an SFP interface and an RJ-45 port. When the SFP interface is active, the adjacent RJ-45 port is disabled. The 1 G ports use LC connectors for fiber-optic connections and RJ-45 connectors for copper connections.

10 G SFP+ Ports

The 10 G ports use LC connector cables for fiber-optic connections and RJ-45 connector cables for copper connections. The SFP slots support only SFP+ modules. These SFP+ modules are field replaceable, and provide uplink interfaces when installed in an SFP+ module slot.

For more information on compatible Cisco SFP+ modules, see the Cisco Catalyst PON Series Switches Release Notes.

Reserve Alarm Port

The reserve alarm port connects to external monitoring systems such as the Environment Monitor System.

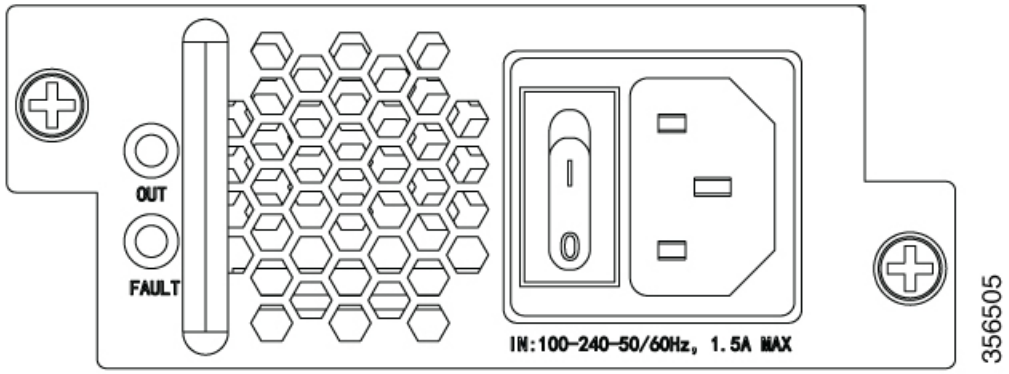
Note This functionality is currently disabled.

Power Supply

The Cisco Catalyst PON Series OLT chassis has redundant power supply slots that operate with one or two power supply modules. The chassis supports field-replaceable AC-input and DC-input power supply modules.

Note Hybrid power supply plugs are not supported.

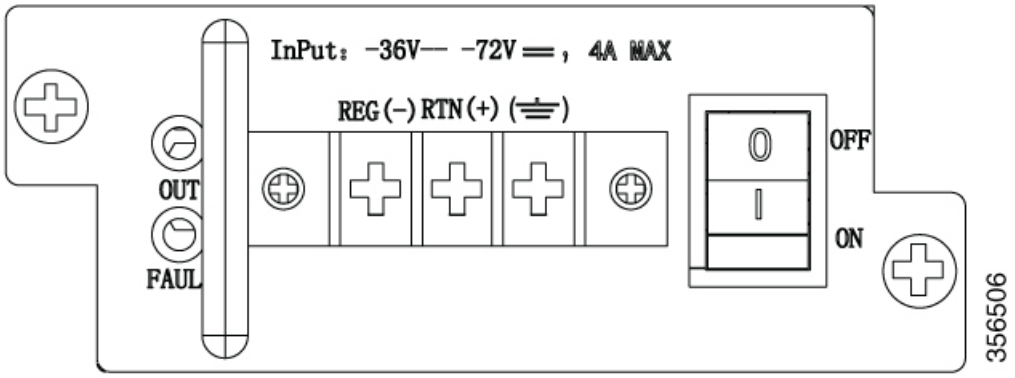
AC Power Supply



The following table lists the power supply ratings.

Input Voltage (VAC)	Output Power (Watts)
220	100
110	100

DC Power Supply



The following table lists the power supply ratings.

Input Voltage (VAC)	Output Power (Watts)
-36 to -72VDC (with extended range upto -75VDC) Voltage differential between inputs is unlimited.	100

LEDs

You can use LEDs to monitor the activity and performance of Cisco Catalyst PON Series OLT.

Table 2: System LEDs

LED	Color	Indication
PWR1 and PWR2	Green (solid)	Normal power from power supply
	OFF	No power from power supply
RUN	Green (blinking)	OLT is running normally
	OFF or Green (solid)	OLT is not running or OLT is running abnormally
AUX	OFF	Auxiliary port is not connected
	Green (solid)	Auxiliary port is connected, but not transmitting data
	Green (blinking)	Auxiliary port is connected and is transmitting data
OUT	Green (solid)	Power supply is normal
	OFF	No power supply

LED	Color	Indication
FAULT	Red (Solid)	Power supply is abnormal
	OFF	Power supply is normal

Table 3: Port LEDs

LED	Color	Indication
PON port		
REG	Green (solid)	ONT is registered on the OLT.
	OFF	No ONT is registered on the OLT.
ACT	Green (blinking)	OLT is receiving and transmitting data
	OFF	OLT is not receiving and transmitting data
1 G port and 10 G port		
LINK	Green (solid)	Connection is established
	OFF	No connection
ACT	Green (blinking)	OLT is receiving and transmitting data
	OFF	OLT is not receiving and transmitting data

Cisco Catalyst PON Series ONT Overview

The Cisco Catalyst PON Series ONT is an optical modem device that is integrated with powerful interoperability and high performance. (An ONT is also referred to as Optical Network Unit [ONU]. ONT is an ITU-T term, while ONU is an IEEE term.) The Cisco Catalyst PON ONT is located at an end user’s premises. The Cisco Catalyst PON Series ONT connects to the PON network on one side and accesses the end user's devices in FTTH, or FTTO, or FTTC service delivery architecture on the other side. The Cisco Catalyst PON Series ONT communicates between the Cisco Catalyst PON Series OLT and the end-user devices.

In the upstream direction, a Cisco Catalyst PON Series ONT is connected to the optical splitter through the PON port. The data, voice, and video signals from end user's devices are sent to the Cisco Catalyst PON Series ONT. Using the uplink ports on the Cisco Catalyst PON Series ONT, these signals are converted into electrical signals and transmitted over optical fibers to the Cisco Catalyst PON Series OLT. In the downstream direction, the Cisco Catalyst PON Series ONT is connected to various end user devices using the 1 G ports and provides triple-play services such as high-speed internet (HSI), voice (VoIP), and video (IPTV and RF overlay).

Cisco Catalyst PON Series ONT provides 1xPON port, 4x1 G 10/100/1000 PoE port, and 1xUSB Type A port with 2xForeign Exchange Station (FXS) port, and 1xcoaxial cable television (CATV) port, which is optional.

Cisco Catalyst PON Series ONT Models

The following table lists the Cisco Catalyst PON Series ONT models and their description.

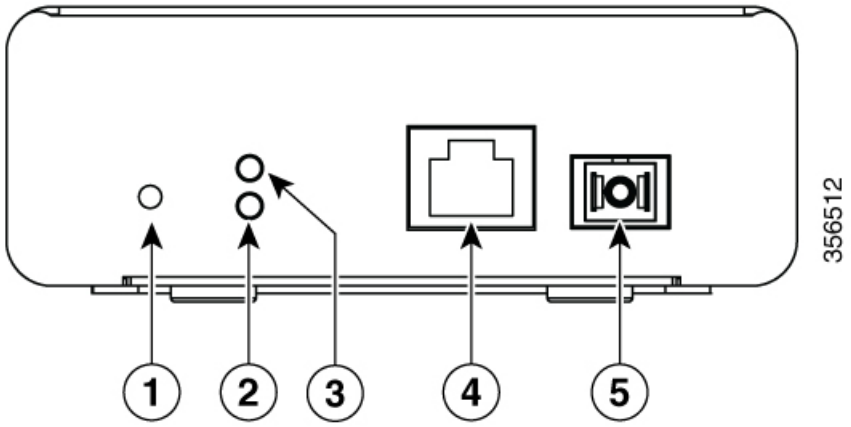
Table 4: Cisco Catalyst PON Series ONT Models and Description

ONT Model	Description
CGP-ONT-1P	Cisco Catalyst PON ONT with 1xPON port and 1x1 G 10/100/1000 PoE port.
CGP-ONT-4P	Cisco Catalyst PON ONT with 1xPON port, 4x1 G 10/100/1000 PoE port, and 1xUSB Type A port.
CGP-ONT-4PV	Cisco Catalyst PON ONT with 1xPON port, 4x1 G 10/100/1000 PoE port, 1xUSB Type A port, and 2xFXS port.
CGP-ONT-4PVC	Cisco Catalyst PON ONT with 1xPON port, 4x1 G 10/100/1000 PoE port, 1xUSB Type A port, 2xFXS port, and 1xCATV port.
CGP-ONT-4TVCW	Cisco Catalyst PON ONT with 1xPON port, 4x1 G 10/100/1000 port, 2xFXS port, 1xUSB Type A port, 1xCATV port, and supports 802.11ac wireless.

Front Panel

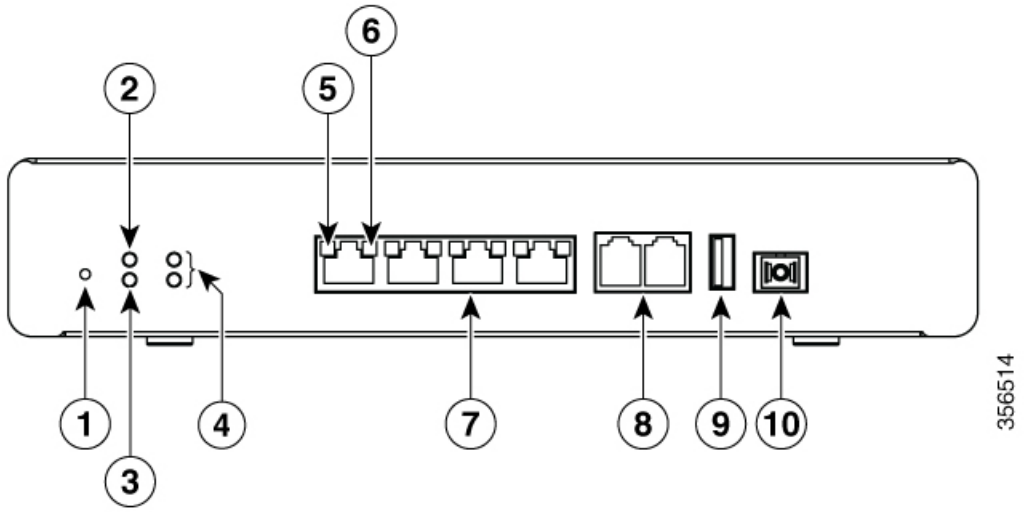
This section describes the front-panel components of a Cisco Catalyst PON Series ONT.

Figure 5: Front panel of CGP-ONT-1P



1	Reset button	4	1 G port
2	PON LED	5	PON port
3	Power LED	-	-

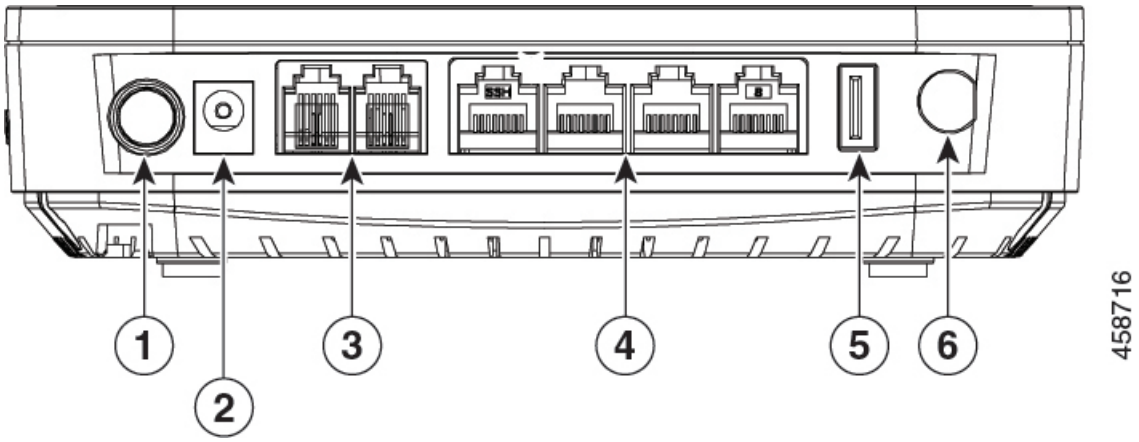
Figure 6: Front Panel of CGP-ONT-4PVC



1	Reset button	6	PoE LED
2	Power LED	7	1 G ports
3	PON LED	8	FXS ports [1]
4	FXS LED[2]	9	USB port
5	1 G LED	10	PON port

[1] Not available on all ONT models
[2] Not available on all ONT models

Figure 7: Front panel of CGP-ONT-4TVCW



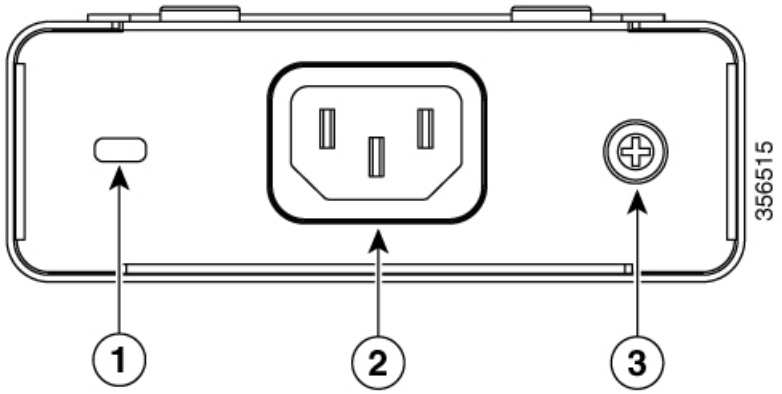
1	Power button	4	1 G ports
2	DC power connector	5	USB Type A port

3	FXS ports	6	CATV port

Rear Panel

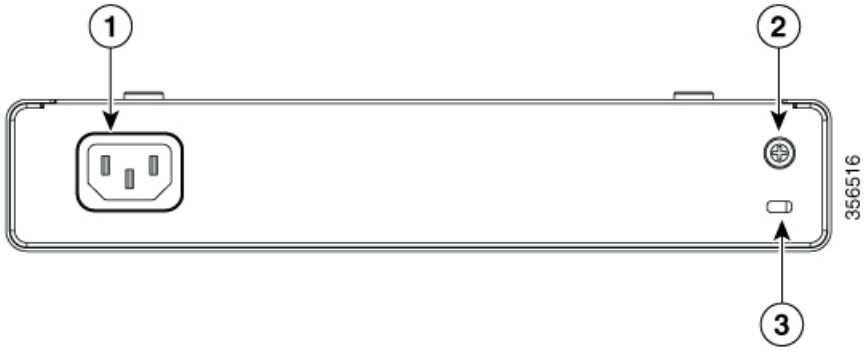
The section describes the rear-panel components of a Cisco Catalyst PON Series ONT.

Figure 8: Rear panel of CGP-ONT-1P



1	Lock slot	3	Grounding connector
2	AC power connector	-	-

Figure 9: Rear Panel of CGP-ONT-4PVC

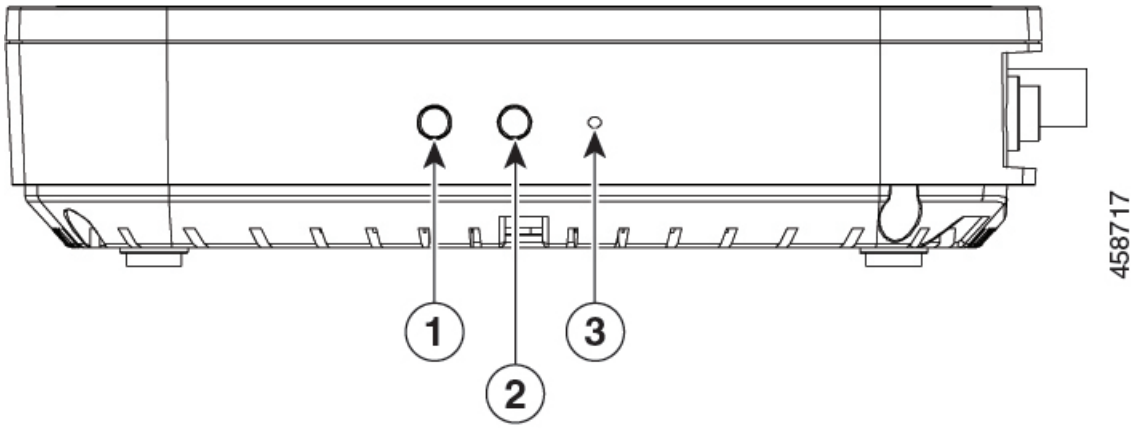


1	AC power connector	3	Lock slot
2	Grounding connector	-	-

Side Panel

The section describes the side-panel components of CGP-ONT-4TVCW.

Figure 10: Side Panel of CGP-ONT-4TVCW

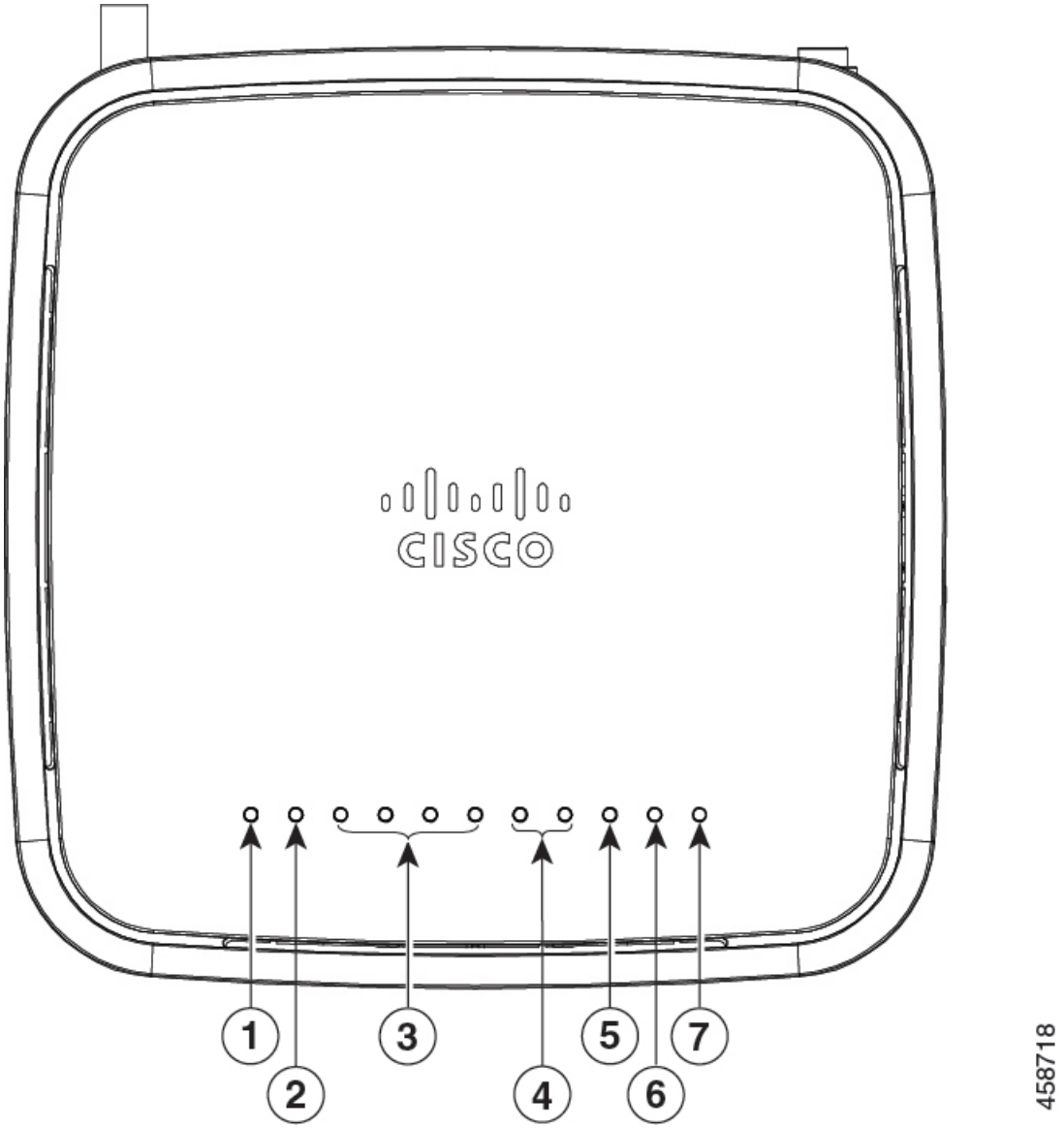


1	Light button	3	Reset button
2	WiFi button	-	-

Top Panel

This section describes the top-panel components of CGP-ONT-4TVCW.

Figure 11: Top panel of CGP-ONT-4TVCW



1	Power LED	5	CATV LED
2	PON LED	6	2.4 GHz LED
3	1 G LED	7	5 GHz LED
4	FXS LED	-	-

Ports

1 G 10/100/1000 PoE Ports

The Ethernet ports use RJ-45 connector cables with Ethernet pinouts. The 10BASE-T, 100BASE-TX, and 1000BASE-T traffic requires Category 5 or Category 5e twisted pair (UTP) cable. The 10BASE-T traffic can use Category 3 or Category 4 UTP cable.

The ports also provide PoE support for devices that are compliant with IEEE 802.3af and IEEE 802.3at.

FXS Ports

The FXS ports use RJ-11 telephone cables.

PON Port

The PON ports use multi-source agreement (MSA) type UPC or SC-PC fiber connector cables. The PON ports range is from 8 to -29 dBm.

USB Port

A USB type A console port is provided for log and configuration file management.

CATV Port

The CATV port uses a coaxial cable.

LEDs

You can use the LEDs to monitor the activity and performance of Cisco Catalyst PON Series ONT.

Table 5: LEDs on CGP-ONT-1P, CGP-ONT-4P, CGP-ONT-4PV, and CGP-ONT-4PVC

LED	Color	Indication
PWR	Green (solid)	Normal power from power supply.
	OFF	No power from power supply.
PON	Green (solid)	ONT is active and registered successfully.
	Green (flashing)	ONT is either inactive or being registered.
	Red (flashing)	Loss in optical signal power.
	OFF	PON module is not ready.
1 G (1–4)		
Right LED	Amber (solid)	Power device is connected.
	OFF	Power device is not connected.

LED	Color	Indication
Left LED	Green (solid)	Link is up but is not transmitting data.
	Green (flashing)	Link is up and transmitting data.
	OFF	Link is down.
FXS (1–2)	Green (solid)	Softswitch is successfully registered.
	Green (flashing)	Calling or being called.
	OFF	Softswitch is not successfully registered.
CATV	Green (solid)	Cable is connected and input power is within normal range (-15 to -5 dBm).
	OFF	Cable is either not connected or cable is connected but input power is not within normal range.

Table 6: LEDs on CGP-ONT-4TVCW

LED	Color	Indication
PWR	Green (solid)	Normal power from power supply.
	OFF	No power from power supply.
PON	Green (solid)	ONT is active and registered successfully.
	Green (flashing)	ONT is either inactive or being registered.
	Red (flashing)	Loss in optical signal power.
	OFF	PON module is not ready.
1 G (1–4)	Green (solid)	Link is up but is not transmitting data.
	Green (flashing)	Link is up and transmitting data.
	OFF	Link is down.

LED	Color	Indication
FXS (1–2)	Green (solid)	Softiswitch is successfully registered.
	Green (flashing)	Calling or being called.
	OFF	Softswitch is not successfully registered.
CATV	Green (solid)	Cable is connected and input power is within normal range (-15 to -5 dBm).
	OFF	Cable is not connected or cable is connected but input power is not within normal range.
2.4 GHz	Green (flashing)	802.11ac wireless transmitting at 2.4 GHz.
	OFF	2.4 GHz radio is disabled.
5 GHz	Green (flashing)	802.11ac wireless transmitting at 5 GHz.
	OFF	5 GHz radio is disabled.

Lock Slot

The Cisco Catalyst PON Series ONT has a lock slot on the rear panel. You can install an optional cable lock, such as the type that is used to secure a laptop computer, to secure the Cisco Catalyst PON Series ONT.

Cisco Catalyst PON Manager Overview

Cisco Catalyst PON Manager is a software platform with highly customized and scalable network management. Based on the configurations, Cisco Catalyst PON Manager can automatically discover various data devices on the network, and dynamically design the network topology. The intuitive network topology allows easy monitoring and managing of networks and devices in each network.

The Cisco Catalyst PON Manager works on a client-server model and operates on Windows operating system.